

Environmental Hazards of Dumpsites in Ibadan, Nigeria

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The aim of this study is to investigate the perceived environmental hazards associated with living and working close to dumpsites in Ibadan, Nigeria. Data for the study were collected using structured questionnaires, key informant interview, and secondary sources such as Ibadan landfill data. Simple descriptive statistical tool of Statistical Package for Social Science (SPSS) software was used for analysis of data. Results from the study revealed that major environmental hazards perceived by respondents are housefly and/or mosquito, odour, and smoke with health risks, inconveniences, and possibly a factor contributing to slow pace development in the communities. The tipping of waste and monthly fumigation of dumpsites by Oyo State Waste Management Authority (OYOWMA) are not sufficient for the reduction of odour or control of houseflies. Respondents perceive that relocation of the dumpsites far away from human habitation will be the best solution to the environmental and health menace caused by the dumpsites. Future studies should include the economic, technical, and environmental analysis of solid waste recycling systems such as the use of organic waste for compost making and 'waste to energy' projects like biogas as it will be a valuable input that will inform policies and encourage small scale investments.

Keywords: Solid Wastes, Dumpsites, Environmental Hazards, Health Risks, Management, Nigeria.

INTRODUCTION

Solid wastes constitute a growing environmental problem globally. Population growth and industrialization are main factors contributing to increased volume of solid waste generation in Ibadan metropolis (Ayininuola and Muibi, 2008). According to United Nations – Habitat (2014), Ibadan is ranked the third largest city on the basis of

population with about 2.9 million people in the year 2011 and an annual increase of over 100 000 inhabitants at 4.59 % growth rate. The solid waste disposal facilities in the city of Ibadan are not sufficient to effectively manage the steady increase in the amount of solid waste generated. Consequently, the pressure on dumpsites in the city is likely to increase including the rise in environmental pollution and health hazards. Common problems arising from indiscriminate disposal of solid wastes in Ibadan include blockage of drainage systems; soil, water and air pollution

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and health problems such as diarrhoea, cholera, and dysentery (Oyediran and Adeyemi, 2011; Omole and Alakinde, 2013; Moruff, 2014). The challenges to the management of solid wastes in developing countries like Nigeria include limited data on solid waste generation, weak policies/environmental laws, poor town planning, lack of efficient and safe disposal and/or recycling technologies, and poor infrastructure for measurement of environmental impact and associated health hazards of unsafe disposal of solid wastes (Nubi, et al., 2006; Oyeniyi, 2011; Etusim, et al., 2013; Anyanwu and Adefila, 2014). The aim of this study is to investigate the perceived environmental and health hazards associated with living and working close to dumpsites in Ibadan, Nigeria as well as an overview of the management of the dumpsites. Other objectives include:

- to identify strategies adopted for coping with environmental hazards by residents living and working close to dumpsites in Ibadan, Nigeria.
- to provide an overview of respondents' perceived solutions to environmental hazards from dumpsites in Ibadan, Nigeria.

MATERIALS AND METHODS

Study area

Ibadan is the capital city of Oyo State, Nigeria comprising 11 local government areas (LGAs). The city is located in the south-western part of Nigeria (longitudes 3°30'25" and 4°9'3" east of the Greenwich Meridian and latitude 7°44'18" and 7°2'39" north of the equator and about 145 km north-east of Lagos, Nigeria). It has a total land area of 3 123 km² and is at an average altitude of about 200 m above sea level. The city is characterized by large and small industries (agro allied and manufacturing industries) and different types of institutions (educational/research institutes, religious and medical centers). The city of Ibadan is serviced by four dumpsites namely; Lapite, Ajakanga, Aba-eku and Awotan, located in Akinyele, Oluyole, Ona-ara and Ido local government areas respectively (Figure 1). The four dumpsites are solely managed by the Oyo state government through the Oyo State Waste Management Authority (OYOWMA). According to OYOWMA, Aba-eku is the oldest dumpsite established in 1985 while the largest

dumpsite is Awotan occupying 20 hectares followed by Ajakanga, Aba-eku, and Lapite occupying 10, 9.4, and 9 hectares respectively. Conversely, records from 2015 data of waste deposited at dumpsites revealed that Ajakanga had the highest (162 117 metric tons) of annual waste followed by Aba-eku, Awotan, and Lapite (102 705, 95 775, and 87 218 respectively). Furthermore, a decreasing trend in the daily average volume and annual total volume of waste were recorded from the four dumpsites from 2012 to 2015 (Figure 2). This could be as a result of increasing number of illegal refuse dumps within the city of Ibadan.

Data collection

Key informant interview (KII) was used to obtain data on location and characteristics of the dumpsites including information on management practices by OYOWMA. Structured questionnaire was used to assess information on environmental hazards from dumpsites, effects of environmental hazards on residents, strategies adopted for coping with environmental hazards including communal efforts for managing environmental hazards from dumpsites, and respondents' perceived solutions to environmental hazards from dumpsites. Out of 324 questionnaires that were administered, a total of 304 were filled and retrieved from respondents (survey response rate = 93.8 %).

Population and Sampling

Standard setback area of 250 meters referred to as minimum distance between a dumpsite and residential developments by the United Nations Environment Programme (UNEP, 2005) was used for this study. Images of the four dumpsites in Ibadan were obtained from Google Earth. Points were created on the images to serve as reference points. The images were inputted into ArcGIS 10.1 software. The points created were geo-referenced and a buffer of 250 meters from the boundary of each of the dumpsites were created (example- see Appendix 1 for Lapite Dumpsite). Taro (1967) technique for sample selection was used to derive the sample size. Summary of population and sample size is presented in Table 1.

$$\text{Taro's formula: } n = \frac{N}{\{1+(N \times e^2)\}} \quad (1)$$

Where: n= sample size

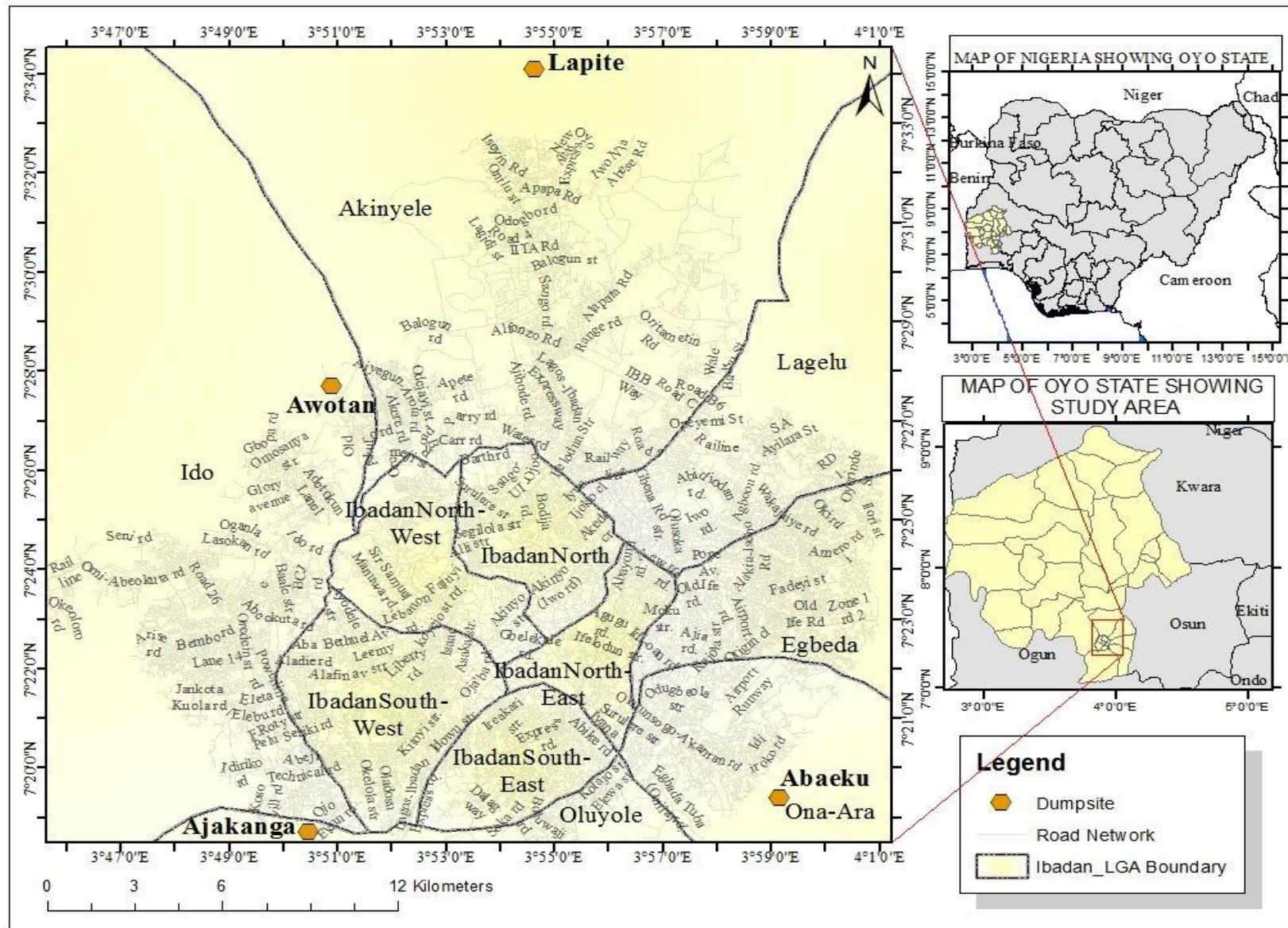
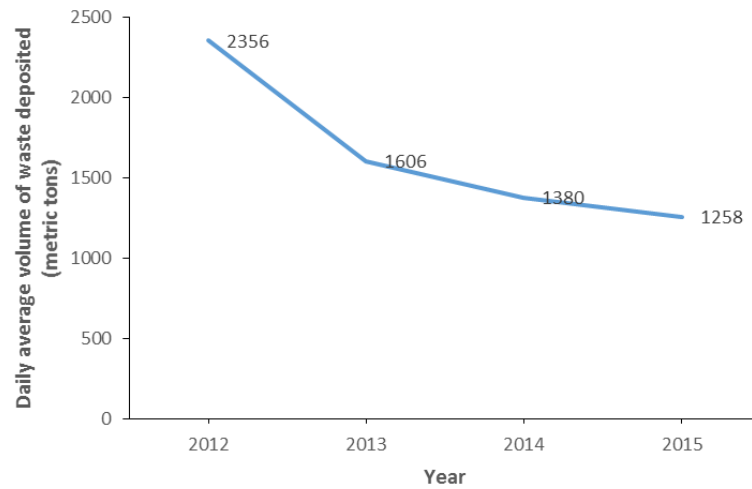
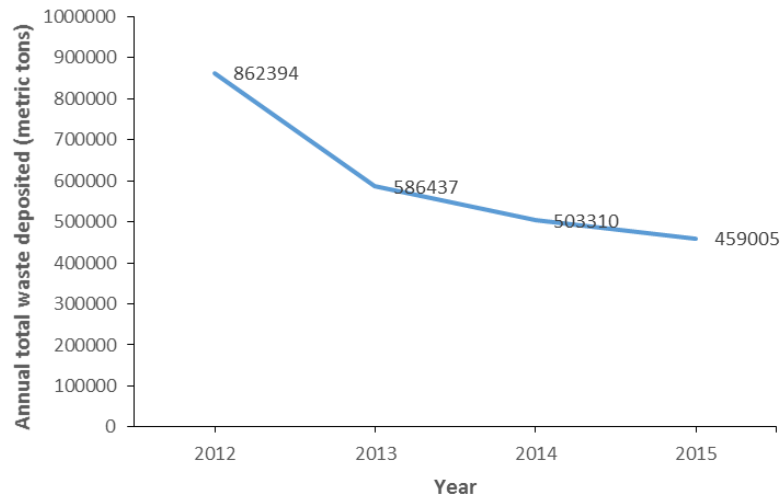


Figure 1. Location of Ibadan and dumpsites.



(a) Daily average volume of waste deposited in Ibadan dumpsites



(b) Annual volume of waste deposited in Ibadan dumpsites

Figure 2. Daily average volume and annual total volume of waste deposited in Ibadan dumpsites, Nigeria (Source: OYOWMA landfill data 2012-2015).

Table 1. Summary of Population and sample size.

S/No	Dumpsite	Population	Sample Size
1	Lapite	20	20
2	Ajakanga	80	80
3	Awotan	271	119
4	Aba eku	239	105
Total		610	324

Table 2. Environmental hazards from dumpsites in Ibadan, Nigeria.

Environmental Hazard	N	Percentage
Smoke	214	70.4
Odour	224	73.7
Dust	81	26.6
Blown litter	83	27.3
Rodent Infestation	76	25.0
Housefly/ Mosquito	235	77.3
Water pollution	34	11.2
Noise from waste trucks	13	4.3

N= Total population

e= error margin (at 95% confidence level)

Total population for Awotan (271) and Abaeku (239) dumpsites = 271+239 = 510

Using Taro Yamane's formula: $n = \frac{510}{\{1+(510 \times 0.05^2)\}}$

n= 224 respondents

Percentage contribution = 53.1 % and 46.9 % for Awotan dumpsite and Abaeku dumpsite respectively.

Sample size for Awotan dumpsite = 53 % \times 224 = 119

Sample size for Abaeku dumpsite = 46.9 % \times 224= 105

The total population within buffer for Lapite dumpsite and Ajakanga dumpsite (20 and 80 respectively) were used as sample size since they are small.

Therefore, total sample size (total respondents for the four dumpsites) = 20 + 80 + 119 +105 = 324.

Data Analysis

Data collected from the field were coded and analysed using simple descriptive statistical tool of Statistical Package for Social Science (SPSS, Version-22, SPSS Inc. New York, NY, USA) software. Descriptive statistics such as percentage was used to summarize bulky data and for easy understanding results were presented using bar charts, line graphs, and tables.

RESULTS

Environmental Hazards from Dumpsites in Ibadan, Nigeria

Field visits to the dumpsites revealed that wastes

are not sorted before disposal at the dumpsites, as a result wastes such as food wastes, metals, industrial wastes, and plastics are deposited together (see Appendix 2). The environmental hazards from dumpsites indicated by the respondents are smoke, odour, dust, blown litter, housefly/mosquitoes, water pollution, rodent infestation and noise from waste trucks (Table 2). Respondents perceive that housefly and/or mosquito is the most experienced environmental hazard from the dumpsites accounting for 77.3 %.

Note: Total number of respondents = 304

N = Number of responses to a particular environmental hazard

Percentage = N/ Total number of respondents * 100

Effects of environmental hazards on communities within dumpsites in Ibadan, Nigeria

Majority of the respondents are of the view that the slow pace of development in their communities can be attributed to smoke (38.9 %), odour (40.1), dust (46.2 %), blown litter (35.1 %), rodent infestation (32.1), housefly/mosquito (30.0 %), and water pollution (36.8 %) from dumpsites (Figure 3).

Strategies adopted for coping with environmental hazards by residents living and working close to dumpsites in Ibadan, Nigeria

In coping with the environmental and health hazards from dumpsites, majority (27.0 %) of the respondents stay indoors and shut their doors so as to reduce air pollution (inflow of smoke and odour) from dumpsites into their homes (Figure 4). This is followed by respondents who use insecticide (20.9%) to control both mosquitoes and houseflies; 15.8 % who use window and door nets to restrict the movement of houseflies and mosquitoes into their homes, and 10.8 % who keep clean environment to control houseflies. Communal efforts for managing environmental hazards from dumpsites in Ibadan is mainly by correspondence to local governments where the dumpsites are located accounting for 50.7 % of the respondents (Figure 5). The communities have on many occasions chosen representatives to visit OYOWMA to make their plight known to them and to seek for a redress. However, majority (69.3 %) of the respondents are of the view that the relocation of the dumpsites far away from human

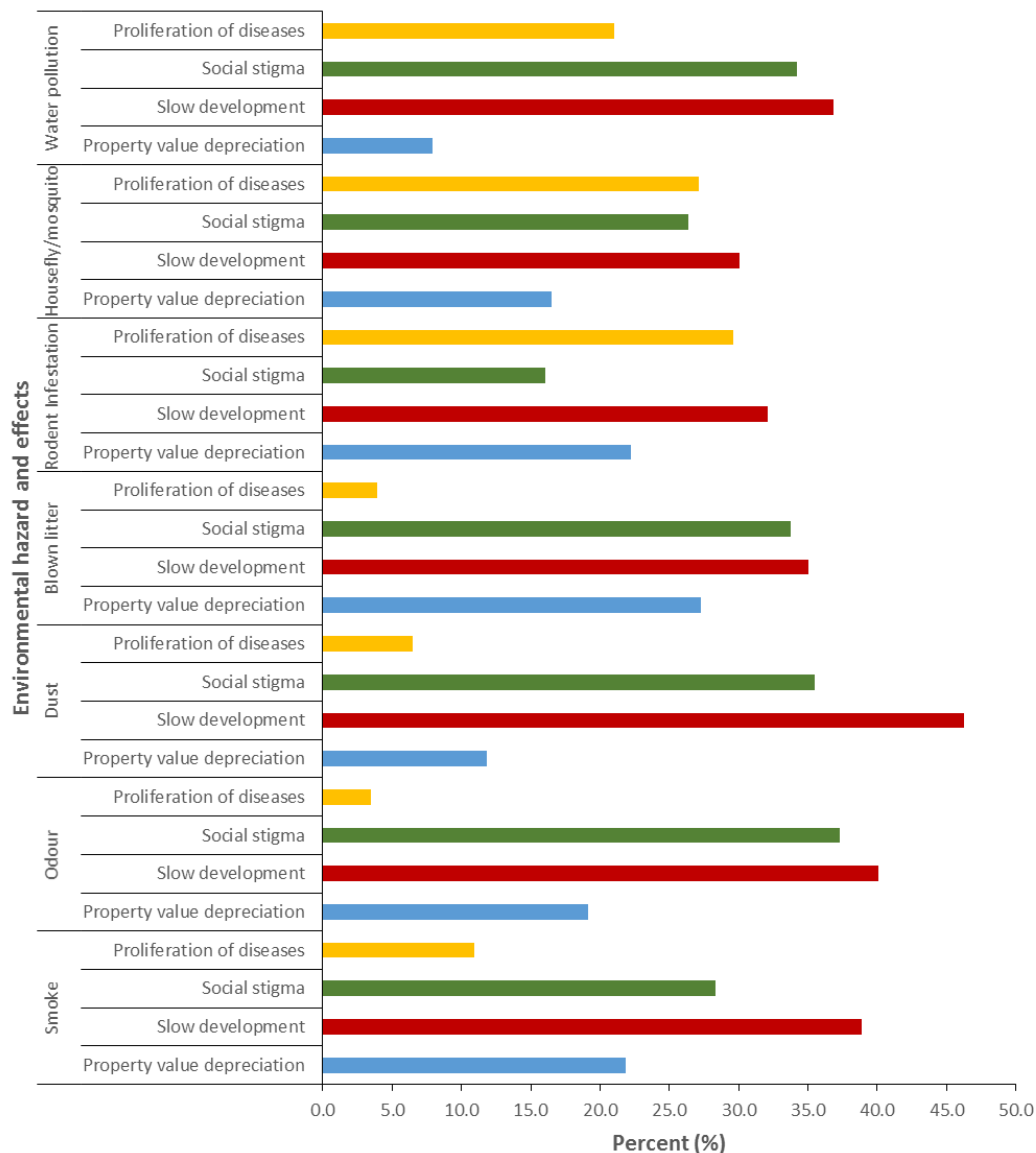


Figure 3. Effects of environmental hazards on communities within dumpsites in Ibadan, Nigeria.

habitation will be the best solution to the environmental hazards from the dumpsites (Figure 6). Also suggested were setting up efficient waste recycling systems and regular fumigation of the dumpsites accounting for 12.3 and 11.9 % respectively.

Control measures of environmental hazards from Ibadan dumpsites by OYOWMA

The methods adopted by OYOWMA to control the various environmental hazards from the dumpsites

are summarized in Table 3. Fire/smoke is controlled at Ibadan dumpsites by tipping. This is done to create space for more refuse deposition and to reduce pore spaces in waste pile that could aid fire outbreak. In the past, the state fire service department is called upon during fire outbreak but as fire outbreak became regular, the authority had to drill boreholes at the dumpsites to provide the needed water to quench fire. Unfortunately over the years, the boreholes have not been functional and in event of fire outbreak, the communities left to suffer the adverse effects from such fires/smoke.

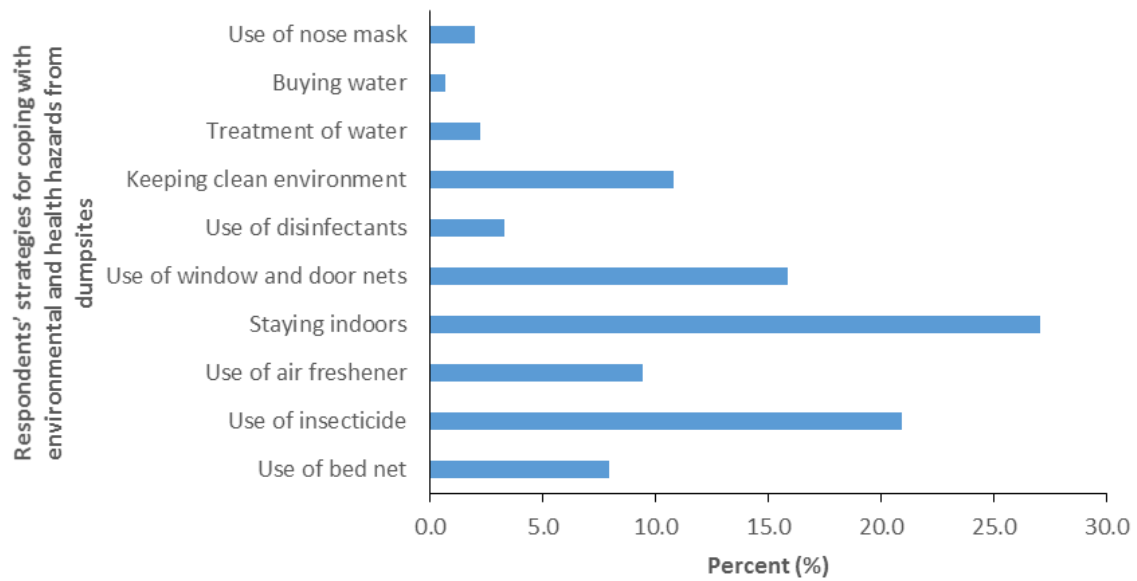


Figure 4. Strategies adopted for coping with environmental and health hazards by residents living and working close to dumpsites in Ibadan, Nigeria.

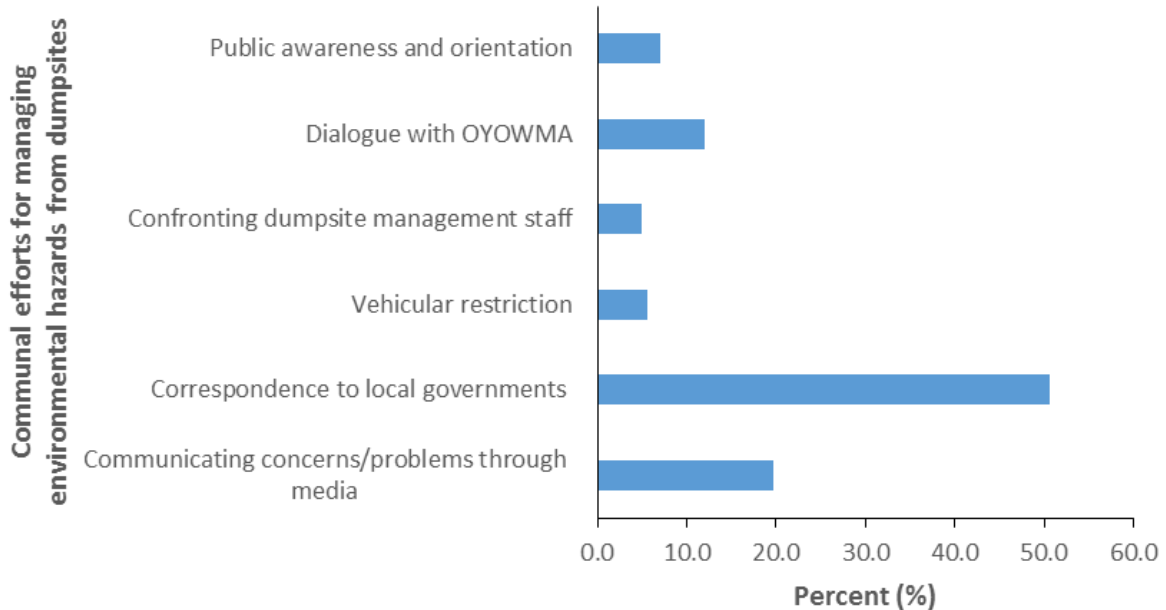


Figure 5. Communal efforts for managing environmental hazards from dumpsites in Ibadan, Nigeria.

Basically, Ibadan dumpsites are fumigated once in a month to control houseflies and to reduce the odour that emanate from dumpsites. Discussions during

the KII revealed that fumigation once in a month may only be 40 % effective to control houseflies and reduce odour. Some respondents who confirmed

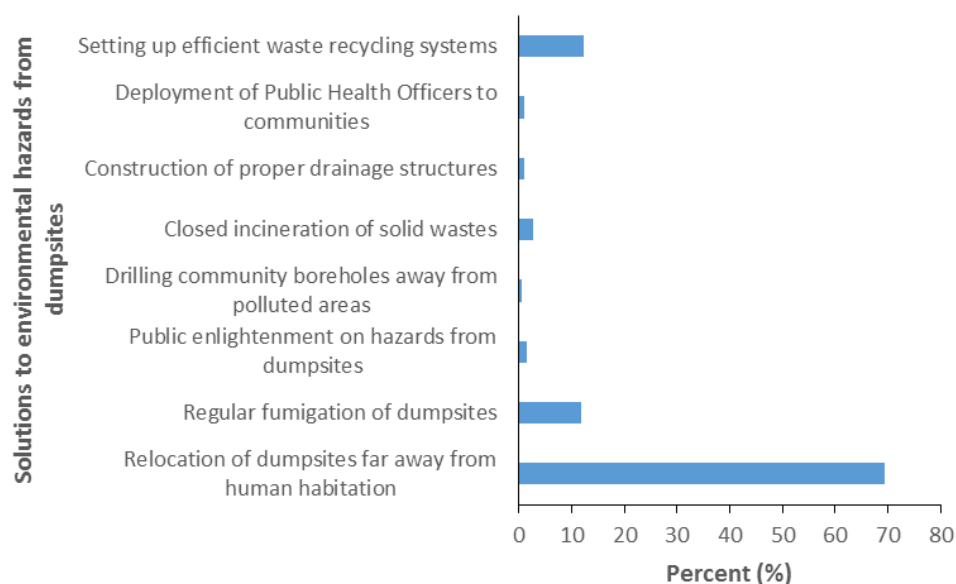


Figure 6. Respondents' perceived solutions to environmental hazards from dumpsites in Ibadan, Nigeria.

Table 3. Dumpsites environmental control measures by OYOWMA

Environmental hazard	Method of control
Smoke/fire	Tipping and drilling of boreholes at dumpsites
Odour	Monthly fumigation
Dust	None
Blown litter	Fencing
Rodent infestation	None
Housefly	Monthly fumigation
Water pollution	None

Source: Key informant interview (2016).

that the dumpsites are fumigated claimed that the effect of the fumigation only last for 2 – 3 days. Therefore, weekly fumigation may be effective for controlling odour and house flies from the dumpsites. Discussions from KII revealed that there are no control measures put in place for dust, rodent infestation, and water pollution from dumpsites. Fencing for example the Aba-eku dumpsite is used to control windblown litter. However, some areas of the fencing have fallen off leading to blown litter especially polythene bags and other lightweight materials been trapped in nearby bushes and drains around the dumpsites.

DISCUSSIONS

Environmental and Health Hazards from Dumpsites in Ibadan, Nigeria

Air pollution caused by odour released from the decay of biodegradables and smoke from open air combustion of solid wastes are high at Ibadan dumpsites with high tendency of GHG emissions such as methane and carbon dioxide. The strong stench from the dumpsites is due to the larger proportion of biodegradable wastes at the dumpsites. At favourable conditions like conducive

temperature and moisture for microbial activities, these wastes are decomposed. During the decomposition process, unpleasant odour is released to the environment. The environmental problems from poor management of dumpsites include air pollution from dust, odour or greenhouse gas emissions such as carbon dioxide and methane from open combustion and/or anaerobic decomposition of waste (Odeyemi, 2012; Zhao et al., 2015).

The prevalence of housefly and/or mosquito experienced in the dwellings of respondents can be attributed to the dirty environment generated by dumpsites which serves as source of food and breeding environment for houseflies and mosquitoes. Although dust, rodent infestation and water pollution are not very common in Ibadan dumpsites but if left unattended, they may lead to very severe cumulative negative health and environmental hazards. For example, water pollution from dumpsites occurs when leachates infiltrates the soil to groundwater resources. Similarly, runoff from dumpsites can pollute surface water resources. Leachates from dumpsites contain heavy metals such as chromium (Cr), zinc (Zn), copper (Cu), cadmium (Cd), lead (Pb) and nickel (Ni) which are not only potential source of contamination to soil and water resources (surface water and groundwater) but also harmful to human life as they enter food chain through plant and animal uptake (Abdus-Salam, 2009; Kola-Olusanya, 2011; Magaji, 2012; Egharevba, et al., 2013; Oni and Hassan, 2013; Ukpong, et al., 2013; Ogu and Ogwo, 2014). Some of the health risks are respiratory problems, malaria, diarrhoea, cholera, chest pain, headache, fatigue, kidney diseases like nephritis, and can also lead to the damage of the liver, brain, central nervous system and reproductive system (Abul, 2010; Odeyemi, 2012; Njagi, et al., 2013). Common health risks mentioned by respondents living and working close to dumpsites in Ibadan are respiratory problems and malaria.

Management of Dumpsites in Ibadan, Nigeria

Ibadan dumpsites seem to be inadequately equipped to effectively manage daily average volume of 1258 metric tons and total annual volume of 459005 metric tons of waste. Monthly fumigation of dumpsites by OYOWMA is not sufficient for the reduction of odour or to control houseflies. Poor management of dumpsites have adverse effects on

the environment and health risks for residents living close to the dumps (Ogunrinola and Adepegba, 2012; Etusim, et al., 2013; Sankoh, et al., 2013).

CONCLUSION

Majority of the respondents perceive that the relocation of the dumpsites far away from human habitation will be the best solution to the environmental and health menace caused by the dumpsites. Presumably, Oyo State Government might not be ready to relocate the dumpsites due to cost which includes cost of structural facilities for management of waste and cost of transporting waste from the city to proposed new dumpsites. Likewise, some of the dumpsites have been in operation before human habitation in the area. The growth rate of the city of Ibadan in terms of population and socioeconomic development may require citizenry to call for relocation of dumpsites in the nearest future when development spreads to new sites. Therefore, relocation of dumpsites may not address the adverse effects of the dumpsites.

RECOMMENDATIONS

The following recommendations can be useful for reducing environmental and health hazards associated with dumpsites in Ibadan, Nigeria:

1. The Oyo State Waste Management Authority can consider waste reduction strategies or recycling systems such as the use of organic waste for compost making and '*waste to energy*' projects like biogas. This includes government promoting small scale investors in biogas and composting plant technologies through trainings and favourable market policies. The projects can provide employment opportunities for residents in the communities within the dumpsites. Harvesting of landfill gas (methane) for biogas energy projects will not only reduce odour, smoke or fire outbreaks from dumpsites but can significantly contribute meeting the energy demand in the area either as stand-alone or back-up for grid energy.
2. Necessary steps towards construction of dumps for leachate collection in dumpsites should be taken by OYOWMA so as to avert the long term pollution of water resources (groundwater and surface water) in the area.

3. Dumpsite rotation which involves the use of one dumpsite at a time to allow the compaction and fumigation of the other three dumpsites can be an effective management strategy that OYOWMA can adopt.
4. Public awareness (enlightenment and orientation) on the dangers associated with poor environmental health for the residents living and working close to the dumpsites should be encouraged. This can be promoted by the government and non-governmental organisations (NGOs) through media- electronic and print.
5. Privatizing the management of the dumpsites can be a giant step in the direction of effective management of the dumpsites. This may adequately equip the dumpsites in terms of technical staff and infrastructural facilities.
6. OYOWMA should adequately enforce monitoring and sanctioning rules that will ensure compliance with specific standards towards the reduction of environmental and health hazards from the dumpsites. A systematic process of monitoring key parameters for solid waste disposal and characteristic activities at the dumpsites should be put in place including performance measurement towards the reduction of environmental and health hazards. Finally, future studies should include the feasibility of sanitary landfills or controlled landfills compared open dumps in Ibadan Nigeria. Also, future research can explore economic, technical, and environmental analysis as well as health benefits of recycling systems such as the use of organic waste for compost making and "waste to energy" projects like biogas. This will inform policies and encourage small scale investments.

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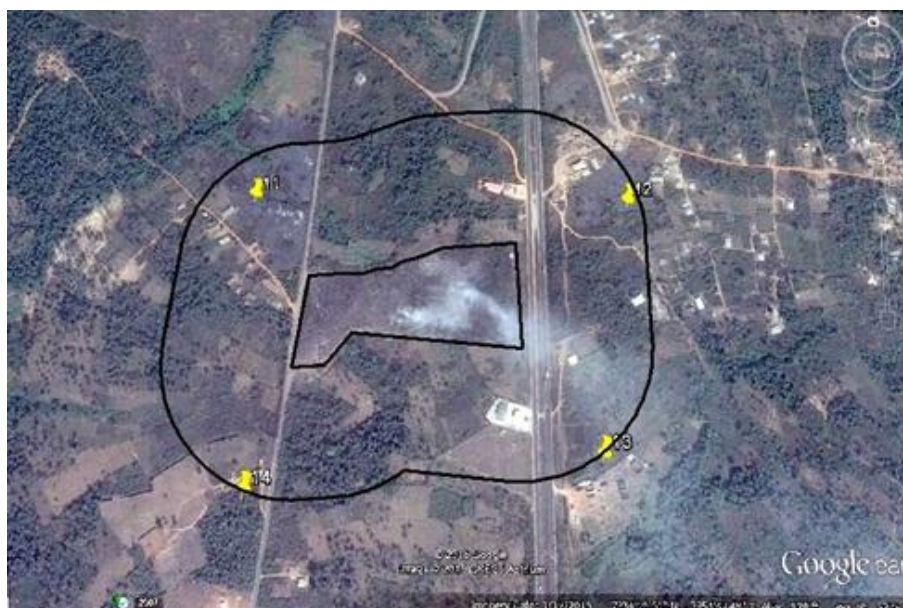
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APPENDICES



Appendix 1. Lapite Dumpsite showing 250m buffer area.



Appendix 2. General Outlook of dumpsites - Lapite dumpsite, Ibadan (Source: Author's fieldwork).